THE OPTICAL EXCITATION FUNCTION OF H(1 s-2p) PRODUCED BY ELECTRON IMPACT FROM NEAR-THRESHOLD TO 1800eV

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The optical excitation function of prompt Lyman-α radiation, produced by electron impact on atomic hydrogen, has been measured over the extended energy range from near-threshold to 1800cV. Measurements were obtained in a crossed-beams experiment using both magnetically confined and electrostatically focused electrons in collision with atomic hydrogen produced by an intense discharge source. A vacuum ultraviolet monochromator system was used to measure the emitted Lyman-α radiation.

Tbc absolute H(1s-2p) electron impact excitation cross section was obtained from the experimental optical excitation function by normalizing to the accepted optical oscillator strength, with corrections for polarization and cascade. Our data arc significantly different from the earlier experimental results of Long *et al*[1] and Williams [2,3], which arc limited to energies below 200cV (scc Figure 1).

Statistical and known systematic uncertainties in our data range from ±4% near threshold to ±2% at 1.8kcV. Multistate coupling affecting the shape of the excitation function up to 1 keV impact energy is apparent in both the present experimental data and theoretical results obtained with convergent c1osc coupling (CCC) theory. This shape function effect leads to an uncertainty in absolute cross sections at the 10% level in the analysis of the experimental data. The derived optimized absolute cross sections arc within 7% of tbc CCC calculations over the energy range 14- 1800cV. The present CCC calculations converge on the Bethe-Fano profile for H(1 s-2p) excitation at high energy. For this reason agreement wilh tbc CCC values to within 3% is achieved in a (nonoptimal) normalization of the experimental data to the Bethe-Fano profile.

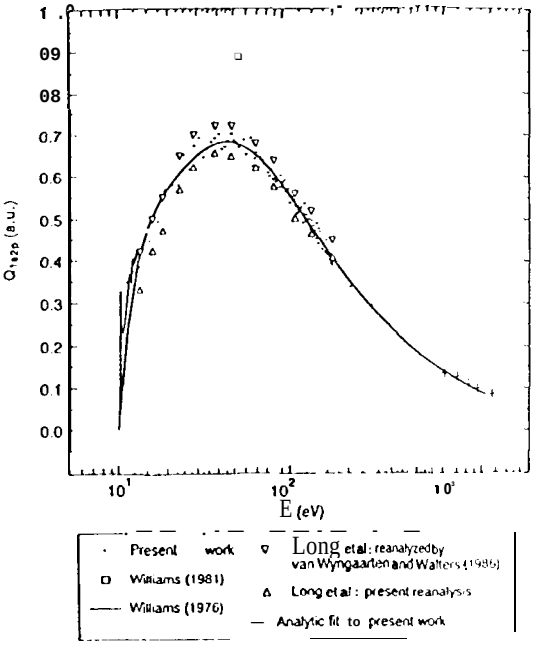

Figure 1. Summary of available experimental H(1 s-2p) cross sections

References:

1. R.L. Long, D.M. Cox and S.J. Smith , *J. Res. Nat.* Bur. *Stand. Sect.A Phys.Chem.* 72A, 521 (1968).
2. J.F. Williams, *J. Phys. B: At. Mol.Phys.* 9, 1519 (1976).
3. J.F. Williams, *J.Phys. B: At.Mol.Phys.* 14, 1197(1981).
4. W.L. van Wyngaarden and H.R.J. Walters, *J. Phys.B: At.Mol. Phys. 191>53* (1986).

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